Roller Coaster Project and Rules

**Introduction:** Six Flags Amusement Park has been hearing from its customers that their roller coasters are boring. The public is threatening that if the amusement park does not build a new, more exciting roller coaster they will stop going to the amusement park.

You are part of a team of engineers that has just been asked to submit a new roller coaster design to the amusement park. Using the concepts of forces, motion, and energy, design and build a model of a workable roller coaster that could be built in the Six Flags Amusement Park.

To appease the public, your roller coaster must have a “thrill factor.” There must be at least one loop, at least one turn, and if possible, a “jump.” Your roller coaster also needs to be safe for the public, so you will also need to calculate the speed, acceleration, PE and KE on various locations of your roller coaster.

You will need to be able to explain your roller coaster to the board of directors of Six Flags. You will need to include in your explanation why you think your roller coaster is the “best choice” and should be built in the amusement park. Keep in mind that the board of directors is made up of a team of scientists. You will want to impress them with your knowledge of how forces, motion and energy help your roller coaster work, why it is safe to ride, and why it is “thrilling.”

Rules

1. Your roller coaster must fit within the confines of your “construction area.” There is no height limit, and you may not intrude on another group’s area without their permission.
2. You may NOT alter the pipe insulation from Ms. Holland if you choose to use it. Remember, you only have a certain amount of supplies. You may not have any replacement supplies if your idea doesn’t work.
3. Your roller coaster must bring your marble safely to a stop. Drops and jumps are permitted, but the marble must be safely caught by the track without getting stuck.

1. Hills and loops must involve trading kinetic energy for potential energy. Horizontal loops are considered turns.
2. Hold on to your marble!!! You must pay for lost marbles, and many roller coasters will work best with one, specific marble. You may need to redesign your roller coaster if you lose your marble.
3. Do not mess around with another group’s roller coaster. This will result in an automatic zero, and removal from the class for the rest of the project.
4. Extra time will not be permitted. Deadlines are absolute. Absences will not result in extra time.
5. Your group is responsible for completely removing your roller coaster and cleaning the surrounding area after completion of the project.

Calculations and Analysis

1. **Draw a Diagram of your coaster and LABEL the following points:**
   1. Where the kinetic energy is the highest
   2. Where the kinetic energy is the lowest
   3. Where the potential energy is the highest
   4. Where the potential energy is the lowest
   5. Where there is positive acceleration
   6. Where there is negative acceleration
   7. Newton’s 1st Law
   8. Newton’s 2nd Law
   9. Newton’s 3rd Law
   10. Two forces that might slow your marble down (what kinds of forces have we talked about in class?)

**Measure and record the following measurements for your roller coaster.**

Time of ride = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (seconds)

Mass of the marble=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (kg)

Go weigh your marble (you may have to weigh it in a cup, then weigh the cup, and subtract to get just the weight of the marble).

Length of the track = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (meters)

**Using the measurements above, calculate the following items for your roller coaster. Please show all of your work and label all of your answers with the correct units!!!!**

1. Average speed of the ride (remember your speed equation???)
2. Acceleration of marble at one location on your roller coaster (remember your acceleration equation???)
3. The Force at one location on your roller coaster. Remember your force equation?

(Use your acceleration from above)

1. Gravitational Potential Energy at the beginning of your ride **P.E=mxhx9.8m/s2**
2. Kinetic Energy at one location on your roller coaster: **K.E = m x v2**

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